

CITY OF LINCOLN NEBRASKA, STANDARD SPECIFICATIONS

Chapter 33

IRRIGATION WORK

ARTICLE	TITLE
33.00	Description
33.01	Quality Assurance
	A. Manufacturer's Qualifications
	B. Materials
	C. Explanation of Design and Drawings
	D. Submittals
	F. Permits and Inspections
	G. Field Record Drawings
	H. Site Check
	I. Delivery, Storage and Handling
33.02	Materials
	A. Acceptable Manufacturers
	B. Copper Piping
	C. PVC Pipe
	D. Polyethylene Pipe
	E. Sprinkler Riser
	F. Gate Valves
	G. Drain Valves
	H. Remote Control Valves
	I. Backflow Preventer
	J. Wiring
	K. Automatic Controllers
	L. Shrub and Lawn Sprinkler Heads
	M. Remote Wireless Valve System
	N. Automatic Valves
	O. Valve Boxes
	P. Irrigation Control Wiring
	Q. Copper Tracer Wire
	R. Backflow Device
	S. Rain Shut-off
	T. Quick Coupler Valves
	U. Backflow Enclosure

33.03	System Design
	<ul style="list-style-type: none"> A. Design Pressures B. Design Velocities C. Location of Sprinkler Heads D. Sectioning of Irrigation System E. Piping F. Excavation and Backfilling
33.04	Installation
	<ul style="list-style-type: none"> A. Installation Schedule and Implementation B. Inspection C. Trenching/Horizontal Boring D. Backflow Preventer E. Circuit Valves F. Plastic Pipeline Fittings G. Control Wiring H. Automatic Controller I. Control Valves J. Valve Boxes K. Drainage L. Sprinkler Heads M. Flushing and Testing N. Adjustments
33.05	Protection and Repairs
33.06	Clean Up
33.07	Final Inspection
33.08	Maintenance
33.09	Operation
33.10	Replacements and Guarantee
33.11	Qualifications for Submitting Bids
33.12	Requirements for Submitting Bids

CHAPTER 33 IRRIGATION WORK

33.00 DESCRIPTION

- A. The work described in this section shall pertain to any irrigation system. Work shall include all labor, material and equipment as well as obtaining all tap fees, permits as may be required to complete the irrigation system as herein specified. The work shall comply with the requirements of all legally constituted authorities having jurisdiction.
- B. Irrigation materials shall mean pipe, irrigation heads, valves, valve boxes, controller, wiring, backflow device, quick coupler valves, protective covers and all description required to be furnished for the project, in accordance with City of Lincoln Standard Plans, Special Provisions, and these Specifications.
- C. This work shall consist of furnishing, delivering and installation of all irrigation material and all operations incidental thereto, in accordance with these Specifications and the Special Provisions, including the following:
 - 1. The regulation and adjustment of all sprinkler heads, timed sequence control devices, sectional valves, rain overrider, etc.
 - 2. The provision of a qualified, sprinkler system technician to instruct the City's operating personnel in the maintenance and operation of the irrigation system.
 - 3. Arrange for, obtain, and pay for all necessary permits, bonds, and fees.
 - 4. Excavating and backfill and compaction for all work as specified, and is to include all machinery and labor.
 - 5. To complete underground irrigation system from the point of connection, throughout the site, including piping, fittings, valves, drains, sprinkler fittings, sprinkler heads, automatic controller(s) and any other necessary appurtenances.
 - 6. To furnish and install all piping, fittings, valves, valve boxes, valve covers, electric valve wiring and appurtenances.
 - 7. To furnish and install all automatic control devices and connect controller to electric service.
 - 8. To test the entire piping and wiring systems.
 - 9. To furnish and install sprinkler heads.
 - 10. To regulate and adjust all sprinkler heads, timed sequence control devices, sectional valves, rain overrider, etc.

33.01 QUALITY ASSURANCE

- A. **MANUFACTURER'S QUALIFICATIONS** - Provide underground irrigation system as a complete unit, including heads, valves, controls and accessories.
- B. **MATERIALS** - Equipment and methods of installation shall comply with the following codes and standards:
 - 1. National Fire Protection Association (NFPA); National Electrical Code
 - 2. American Society for Testing and Materials (ASTM)
 - 3. National Sanitation Foundation (NSF)
 - 4. The Irrigation Association (IA)
- C. **GENERAL IRRIGATION REQUIREMENTS** - Work shall be performed in accordance with the best standard of practice relating to the various trades and under the continuous supervision of an experienced irrigation capable of designing, electronically drawing, and interpretation of specifications appropriate for the project.
 - 1. Coordinate work of this section with site earthwork, plumbing, electrical, concrete work and other trades and schedule in a manner to avoid damage to other work.
- D. **EXPLANATION OF DESIGN AND DRAWINGS**
 - 1. It is intended that the Design represented by the Drawings and Specifications specify an efficient and complete irrigation system for use in accordance with the Manufacturer's recommendations and meeting the City's Engineer, Landscape Architect or Representative's approval.
 - 2. The Irrigation Designer/Contractor shall verify the authenticity of all finish grades within the project area of insurance of proper coverage of the sprinkler system. All finish grades shall be approved in writing prior to installation of the irrigation system. Contractor shall further verify the onsite water pressure. System design is based upon static pressure at the point of connection of each tap with a minimum operating pressure at the irrigation head of 25 psi.
- E. **SUBMITTALS**

Submit manufacturer's product data and installation instructions for each of the system components.

Submit shop drawings for underground irrigation system, including plan layout and details illustrating location and type of heads, valves, piping circuits, controls and accessories. Submit technical data supporting layout design, including individual circuit (section) GPM and pressure loss calculations.

33.01 QUALITY ASSURANCE (Continued)

F. PERMITS AND INSPECTIONS

All work shall comply in every respect with all city, county and state requirements, laws, ordinances, and rules.

The irrigation contractor shall obtain and pay for all licenses, permits, and inspections as required by law for the work specified herein and the accompanying drawings.

This will include backflow prevention equipment with shutoff valves and unions for removal.

G. FIELD RECORD DRAWINGS

Upon completion of the irrigation system, a complete 'record drawing' will be submitted to the City's representative. This drawing shall include a hard copy and an electronic file compatible with the City's CAD system and shall indicate thereon all pipe sizes, valve locations, dimensional data from building walls or column center lines, to the piping and valves, sprinkler heads, etc. Accompanying the record drawings shall be instruction sheets and parts lists, covering all operating equipment, bound into a folder.

H. SITE CHECK

Contractor shall carefully examine the work site, local conditions, specifications and plot plan for any existing utilities. Any damage to existing utilities or existing structures shall be repaired by the Contractor at no cost to the City.

I. DELIVERY, STORAGE AND HANDLING

Deliver irrigation system components in manufacture's original undamaged and unopened containers with labels intact and legible.

Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends, both threaded and unthreaded.

Store and handle materials to prevent damage and deterioration.

Provide secure, locked storage for valves, sprinkler heads, and similar components that cannot be immediately replaced to prevent installation delays.

33.02 MATERIALS

A. ACCEPTABLE MANUFACTURERS

Many of the materials chosen for the design of the sprinkler system, have been specifically referred to by the manufacturer's name so as to enable the City to continue to install similar equipment as utilized on previous projects in the project area. Acceptable manufacturers include:

33.02 MATERIALS (Continued)

Rain Bird

Or equal, if and specifically approved by the the City's Engineer, Landscape Architect or Representative by addendum during the bidding period.

B. COPPER PIPING

Copper piping shall be Type K, hard copper, and will be used on all exposed pipe, i.e. back flow preventer, etc.

Copper pipe fittings shall be wrought solder-type cast solder-joint fittings.

C. PVC PIPE

All PVC pipe shall be virgin, high impact, polyvinyl chloride having a minimum working pressure rating of Class 200 or Schedule 40. All PVC pipe shall be continuously and permanently marked with the manufacturer's name, material size, and schedule of type. Pipe shall conform to U.S. Department of Commerce Commercial Standard CS 207-60, or latest revision. Material shall conform to all requirements of PVC 1120, ASTM D-1785, or latest revision.

Priming and solvent welding shall cause complete leakproof plasticized joint upon evaporation. Solvent shall conform to U.S. Government Specification No. GS-256.63.

D. POLYETHYLENE PIPE

ASTM 2239 flexible polyethylene pipe rated at 100 psi minimum working pressure.

E. SPRINKLER RISER

Standard PVC nipple

F. GATE VALVES

Manufactureres standard of type and size required bass construction conforming to A.W.W.A. Specifications.

G. DRAIN VALVES

Manufacturer's stand of type and size required.

½" Model AFD-0500 antifreeze drain valve manufactured by Kbi or equal, if and as specifically approved by the City's Engineer, Landscape Architect or Representative during the bidding period.

H. REMOTE CONTROL VALVES

Manufacturers standard of type and size required.

33.02 MATERIALS (Continued)

All valves will be located in valve boxes 10 inch minium, plastic construction as manufactured by Amtek Corp. Valve box shall be vandal resistant. Lift off lids are not acceptable.

I. BACKFLOW PREVENTER

Brass construction conforming to City of Lincoln Standard Requirements for turf irrigation systems. Building and Safety recognize two (2) devices appropriate for irrigation systems:

1. Reduced Pressure (RP) principle backflow preventer.
2. Pressurized Vaccum Breaker (PVB). The PVB must be installed a minimum of 12" above the highest sprinkler head or outlet on the system.

J. WIRING

Electric control wires from each controller to the automatic valves shall be direct burial UF wire of a different color than the black and white wires used on the 115 volt A.C. power. Ground wire shall be a different color than the control lines. A ground wire shall be required for each controller.

All wire shall be spliced only at valve locations. Minium size shall be 14 gauge, solid single conductor, copper.

Provide 10" expansion coil at each valve and at 100 intervals.

K. AUTOMATIC CONTROLLERS

Automatic controller shall be a Hunter ICC-800M or approved equal, pedestal mounted. Controller shall be located in a metal, weather proof and locking housing and shall be installed adjacent to the back flow device. Electrical power (120v, 5a) supply and hook-up to the automatic irrigation controller shall be provided by the owner at the location shown on the irrigation plan.

The controller to be installed and wired in accordance with the manufacturer's published instructions.

Construction: Controller shall be enclosed in a structure having a hinged cover with provision for locking. Controller shall be completely electric in operation and shall not employ hydraulic tubing, or otherwise introduce into the controller water or other fluids subject to freezing or leakage.

Location of controller is indicated on drawings.

33.02 MATERIALS (Continued)

L. SHRUB AND LAWN SPRINKLER HEADS

All full and part circle sprinkler bodies and nozzles. These sprinklers shall be of the pop-up type. Spacing of the heads shall not exceed the manufacturer's maximum recommendations.

Matched precipitation will be required on all full and part circle sprinklers on the same zone.

M. REMOTE CONTROL VALVES

Manufacturer's standard of type and size required.

N. WIRELESS VALVE SYSTEM

Must include a fully submersible batter-powered control unit, waterproof and able to perform system checks, up to 100' away without direct access to the control, solenoid design for minimal power consumption, full submersible and waterproof to 12 feet, ability to set each valve up with own start time, run time and day schedule, double-sealed battery compartment and weather sensor compatible.

O. AUTOMATIC VALVES

Remote control valves shall be solenoid operated, diaphragm, globe-type having IPS threads and suitable for underground burial without protection.

Construction: Valve shall be packless, without sliding seals, and completely serviceable without removing body from pipeline. Design shall be normally closed requiring solenoid to be energized to open valve, thereby causing automatic closure in event of power failure. Solenoid shall be comply with Class 2 National Electric Code and when operating require a maximum of 3.0 watts 24 volts AC. Solenoid shall be coated in expoxy to form a corrosion and moisture proof unit with exposed metal components of non-corrosive material.

P. VALVE BOXES

New control valves shall be installed in 12" standard valve box. All valve boxes shall be as manufactured by Ametek, Caroson or approved equal. Valve boxes shall be installed on a minimum of one (1) cubic foot base of washed gravel for proper foundation of box and easy leveling of box to proper grade and also to provide proper drainage of the valve box. Lift off lids are not acceptable.

Q. IRRIGATION CONTROL WIRING

All new wiring to be used for connecting the automatic controller to the electric remote control valves shall be type UF600V, #14, single wire direct burial PE irrigation control cable. It shall be UL listed and have a 4/64" covering of I.C.C. 100 compound insulation. All pilot or "hot" wires are to be of one color and all "common" wires are to be another color. The Contractor is to install two wires of another color in conjunction with the common wire. These extra wires will be used in the case of wire failure. The additional wires shall be a different color than the control and common wires. All wire connections shall be made with 3m DBBY connectors.

33.02 MATERIALS (Continued)

R. COPPER TRACER WIRE

Copper tracer wire should be installed with all piping so that the system made be easily found for purposes of adjustments, repairs, and replacements

S. BACKFLOW DEVICE

The backflow preventer shall be a Febco 765 or approved equal (size as on drawing) pressure type backflow. Size and location shall be per the Irrigation Plan and details or approved equal.

T. RAIN SHUT-OFF

A rain sensing device shall be installed which will override the automatic setting in the event of rain. This device shall be a 'Rain Check', manufactured by Rainbird or equivalent. The device shall be mounted in a location unobstructed by walls, trees, or other hindrances, and shall be located so as not to be vandalized. Contractor shall verify the location and routing or control wires with the City's Engineer, Landscape Architect or Representative prior to installation.

U. QUICK COUPLER VALVES

1. All quick couplers shall be of 5RC body, 55K key and an SH1 swivel 1" shaft x 1" MPT x 3/4" hose thread.
2. Quick coupling valves shall be located within a weather resistant plastic valve box 6 inch minium, with lockable lid. Do not locate within paved surfaces.
3. Fill: Clean soil free fo stones larger than 2" diameter, foreign matter, organic matter and debris. Provide imported fill material as required to complete the work. Obtain rights and pay all costs for imported materials. Suitable excavated materials removed to accommodate the irrigation system work may be used as fill.
4. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3" maximum to 3/4" minimum.
5. Locate within valve box 4" deep layer of coarse gravel beneath the bottom of the valve.
6. Copper Wire: #12 awg copper wire with National Electrical Code type THHN/THWN insulation.
7. Top of quick coupler valves shall be as close to the top of valve box as possible.

V. BACKFLOW ENCLOSURE

1. The backflow device shall have a steel locking vandalism resistant enclosure approved by the City's Engineer or representative.

33.03 SYSTEM DESIGN

System Design should not begin until all existing conditions are satisfactorily understood

A. DESIGN PRESSURES

Determine from the City of Lincoln Public Works Department. Actual working pressure in an individual circuit shall fall between manufacturer's recommended minimum and maximum operating pressures for the last sprinkler head in the circuit.

B. DESIGN VELOCITIES

Velocity of water in sprinkler system should not exceed 5 - 6 fps.

C. LOCATION OF SPRINKLER HEADS

Except for roadway medians, begin sprinkler head location at areas to be bordered (sidewalks, etc.) Fill in with sprinklers in the middle areas. Design for 100% radius overlap coverage. Locate sprinkler heads based on triangular spacing wherever possible. Locate sprinkler heads so that trees are approximately halfway between heads wherever possible. Do not overspray, sidewalks, roadways, or pavements.

D. SECTIONING OF IRRIGATION SYSTEM

Individual circuits shall be designed so that total gallons per minute (GPM) required per circuit does not exceed available GPM. System shall be designed so that areas irrigated by individual circuits exhibit compatible conditions, including soil type, plant material type and sun exposure. System shall be designed so that sprinkler head types and precipitation rates of sprinklers are compatible on same circuit. Design system so that circuits furthest from supply require lowest total GPM. Design system so that each section includes one quick coupling valve.

E. PIPING

Piping should be laid out as to avoid sides of structures, odd angles, unbalanced friction losses, high friction losses, and excessive trenching.

F. EXCAVATING AND BACKFILLING

An excavation shall be considered unclassified excavation and include all materials encountered.

Excavate trenches of sufficient depth and width to permit proper handling and installation of pipe and fittings.

If the pulling method is used, the pipe "plow" shall be a vibratory type. Starting and finishing holes for pipe pulling shall not exceed 1'-0" by 3'-0" opening.

Excavate to depths required to provide 2" depth of earth fill or sand bedding for piping when rock or other unsuitable bearing material is encountered.

33.03 SYSTEM DESIGN (Continued)

Fill to match adjacent grade elevations with approved earth fill materials. Place and compact fill in layers not greater than 6" DEPTH. Provide approved earth fill or sand to a point 4" above the top of pipe. Fill to within 6" of final grade with approved excavated or borrow fill materials free of lumps or rocks larger than 2" in any dimension. Provide clean topsoil free of rocks and debris for top 6" of fill. Install irrigation lines with a minimum cover of 24" for main lines. 12" for laterals based on existing finished grade.

Excavate trenches and install piping and fill during the same working day. Do not leave trenches or partially filled trenches open overnight.

33.04 INSTALLATION

A. INSTALLATION SCHEDULE AND IMPLEMENTATION

1. The irrigation work shall be scheduled by the Irrigation Contractor in such a way that existing underground utilities are protected.
2. The location of each run of pipe, mainline or laterals, and all irrigation head and valves, shall be staked out by the Irrigation Contractor prior to trenching. All pipe, valves, fittings, etc. shall be carefully placed in the locations as shown on the plans and details. The interior of pipes shall be kept free from dirt and debris and when pipe laying is not in progress, open ends of pipes shall be closed by approved means.

B. INSPECTION

When the Irrigation Contractor is prepared for one of the required inspections, the Contractor shall give the City's Engineer, Landscape Architect or Representative adequate notice to visit the site and perform the inspection. This does not preclude the right of the City's Engineer, Landscape Architect, or Representative to make informal inspection at any time during the work of this section. The required inspection for which the Irrigation Contractor must notify the City's Engineer, Landscape Architect or Representative are as follows:

1. UTILITY AND IRRIGATION EQUIPMENT LOCATION STAKING

The City's representative or assigns shall inspect the proposed locations of all Irrigation lines and heads for conformance to the Drawings and Specifications. The City's representative reserves the right to move, shift or adjust any or all of the proposed locations to better achieve the design intentions as shown on the Drawings.

2. WIRING INSPECTION

When the wiring has been installed, the City's Engineer, Landscape Architect or Representative shall inspect for conformance to these Drawings and Specifications.

3. COVERAGE TEST

After the sprinkler heads have been installed and backfilling operations are complete, the Irrigation Contractor, in the presence of the City's representative, shall perform a coverage test to determine if the irrigation system reaches all parts of the areas to be sodded.

33.04 INSTALLATION (Continued)

4. STAKING AND LAYOUT

The Irrigation Contractor shall provide all materials necessary for the staking of the irrigation system. All irrigation heads are to be flagged for the City's representative's observation. Contact the City's representative, in advance, and request inspection of the layout. The City's representative will observe layout and indicate any changes as needed.

C. TRENCHING/HORIZONTAL BORING

1. General: Excavate straight and true with bottom uniformly sloped to low points
2. Minimum Cover: Provide the following minimum cover over top of installed piping:
 - A. Mainline, 18" minimum
 - B. Lateral Lines, 12" minimum
 - C. Piping under pavement, 24" minimum
 - D. Sleeves, 18" minimum
3. BACKFILL: Backfill with clean material from excavation. Remove organic material as well as rocks and debris larger than 1" diameter. Place acceptable backfill material in 6" lifts, compacting each lift and flush with water to settle trench except for pavement. The site shall be continuously cleaned up of excess and/or waste materials as the backfilling progresses and shall be left in a neat and workmanlike condition.
4. EXISTING LAWNS: Where trenching is required across existing lawns, uniformly cut strips of sod 6" wider than the trench. Remove sod in rolls of suitable size for handling and keep moistened until replanted or replaced.
 - A. Backfill trench to within 6" of finished grade. Continue fill with acceptable topsoil and compact to bring sod even with the existing lawn.
 - B. Replant sod within (7) days after removal, roll and water generously.
 - C. Reseed and restore to original conditions any sod areas not in healthy condition equal to adjoining lawns 30 days after replanting.

D. BACKFLOW PREVENTER

Install backflow prevention valve, pump, booster pump, fittings and accessories required to complete the system. Provide union on downstream side. Install minimum 12" above highest ground level sprinkler head.

33.04 INSTALLATION (Continued)

E. CIRCUIT VALVES

Install in accordance to the manufacturer's instructions. Install in valve box, arranged for easy adjustment and removal. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the access box. Provide union on downstream side. Seal threaded connections on pressure side of control valves with Teflon tape or plastic joint type compound. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

F. PLASTIC PIPELINE FITTINGS

1. INSTALLATION

All workmanship and materials shall be in conjunction with all applicable local codes and ordinances of legally constituted authorities; where the provision of these Specifications exceed such requirements, these specifications shall govern. All plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommend by the Manufacturer.

2. SOLVENT-WELD PIPE AND FITTINGS

Install pip in dry weather when temperature is above 40 degrees F and in accordance with manufacturer's installation directions. Provide for thermal expansion and contraction. Solvent-weld plastic pipe shall be cut with a pipe cutter or fine-tooth hacksaw with the assistance of a square-in sawing device or in a manner so as to assure a square cut. Burrs and cut ends shall be removed prior to installations that smooth, unobstructed flow will be obtained. Only the solvent recommended by the manufacturer shall be used. The solvent-weld joints shall be made in the following manner:

Thoroughly clean the mating pipe and fitting with a clean dry cloth. Prime connections prior to solvent welding.

Apply a uniform coat of solvent to the outside of the pipe with a nonsynthetic bristle brush. Apply solvent to the fitting in a similar manner. Re-apply a light coat of solvent to the pipe and quickly in-set it into the fitting.

Give the pipe or fitting a quarter (1/4) turn to insure even distribution of solvent and make sure the pipe is inserted to the full depth of the fitting socket. Hold in position for fifteen (15) seconds . Wipe off excess solvent that appears at the outer shoulder of the fitting. Care should be taken so as not to use an excessive amount of solvent, thereby causes a weakening or obstruction on the inside of the pipe. The joints in the PVC pipe shall be allowed to set at least twenty-four (24) hours before pressure is applied to the system at a temperature above 40 degrees F.

33.04 INSTALLATION (Continued)

The pipe shall be installed and maintained at the proper lines and grades with joints centered and with fittings and other appurtenances at the required locations.

All risers to heads shall be constructed of nipples or elbows to permit height adjustment of head. Install heads two inches back of any hard surface.

3. LINES UNDER PAVEMENT

Provide sleeves (as required) using PVCE pipe sized under walks and paving. Location and depths of sleeves shall be noted on the As-Built Irrigation Plan. All sleeving shall be twice the diameter of the irrigation pipe.

G CONTROL WIRING

1. CONTROL AND COMMON WIRE INSTALLATION

Control, common and extra wires shall be installed beside the mainline and in sleeves where required. Wire shall then be placed as loose as possible to allow for expansion and contraction of the wire. Verification of the wire types and installation procedure should be checked to conform to local codes. Connecting and splicing of wire at the valve or in the field will be made by using DBY wire connectors (as designated by the Details). The Irrigation Contractor shall isolate field splices in one (1) central location, in a valve box, if possible. All field splices shall be installed in a Ametek or Carson valve box.

H. AUTOMATIC CONTROLLER

The Automatic Controller and protective enclosures shall be installed adjacent to the backflow device when possible. Alternative locations must be discussed with City's representative. Install box guard shack or equal enclosure per manufacturer's specifications.

I. CONTROL VALVES

Connect each remote control valve to one station of a controller. Connect remote control valves to a common ground wire system independent of other controllers. Make wire connections to remote control electric valves and splices of wire in the field, using wire connectors and sealing cement in accordance with manufacturer's recommendation.

J. VALVE BOXES

Control valve boxes shall be installed on a minimum of one (1) cubic foot base of clean gravel for proper foundation of box and easy leveling of box to proper grade and also to provide drainage of the valve box.

K. DRAINAGE

Drainage pits shall consist of two (2) cubic foot well, filled to capacity with crushed stone. Drain locations shall be determined on job site by the irrigation contractor. Provide drains at all low points the branch piping and in the main at intervals not to exceed 200 feet of pipe.

L. SPRINKLER HEADS

Unless otherwise specifically designated on the Drawings, the installation of irrigation heads shall include the excavation and backfill, furnishing, installing and testing of risers, fittings and irrigation heads in accordance with the Drawings and Specifications. Pop-up spray irrigation heads shall be installed with swing joint assemblies as per details.

M. FLUSHING AND TESTING

After all new irrigation piping is in place and connected for a given section, and all necessary division work has been completed, prior to the installation of the pop-up nozzles, all control valves shall be opened and a full head of water used to flush out the system. Pressure test all lines before joint areas are backfilled. Backfill a portion of the trench to maintain pipe stability during test period. All mainline piping shall be tested at hydraulic pressure of 100 PSI. Upon visual inspection of each joint and the ground, any leak detected shall be repaired. The line shall be re-tested until the necessary repairs made to the system are in good working order. After testing, the system shall be flushed with the operation flow passing through each pipe, beginning with the larger mains and continuing through the smaller mains in sequence.

N. ADJUSTMENTS

Upon completion of the performance system testing, all necessary repairs and adjustments shall be made.

Adjust sprinklers after installation for proper and adequate distribution of the water over coverage pattern. Adjust for the proper arc of coverage.

The irrigation Contractor and his assigns shall be continue to be responsible for properly making any additional adjustments during the maintenance period.

Tighten nozzles on spray type sprinklers after installation. Adjust sprinklers adjusting screw lateral line or circuit s required for proper radius. Interchange nozzles patterns to provide the best arc of coverage.

Adjust all electric remote control valve pressure regulators and flow control stems for system balance and optimum performance.

Test and demonstrate the controller by operating appropriate day, hour and station selected features as required to automatically start and shut down irrigation cycles to accommodate plant requirements and weather conditions.

33.05 PROTECTION AND REPAIRS

It shall be the responsibility of the Irrigation Contractor to protect and preserve any existing structures, concrete walls, etc. from damage during irrigation construction. If damage does occur, all damage shall be complete repaired or restored by the Irrigation Contractor at no additional cost to the project.

33.06 CLEAN UP

Perform clean up as a continuous operation throughout the duration of the work. Remove from site all excess materials, soil, debris and equipment. Repair damage resulting from irrigation system installation.

Protect irrigation system and materials from damage due to performance of work, operation by other contractors, trades and trespassers. Maintain protection during installation and testing periods.

The entire site shall be left clean and neat.

The contractor shall be responsible for all damage caused by operations to trees, shrubs, curbs, paving, structures, utilities, etc. on the site or adjacent to the site of work and shall repair, replace or otherwise make good any damage caused by work.

33.07 FINAL INSPECTION

When the Irrigation Contractor is satisfied that the system is operating properly, that it is balanced and adjusted, and that all work and clean up is completed, he shall notify the Architects representative that he is prepared for Final Inspection. At the given time, the sprinkler system will be inspected by the architect's representative for the following:

A. SPRINKLER HEADS

1. Heads adjusted to grade.
2. Heads properly aligned.
3. Nozzles properly adjusted.
4. Broken heads replaced.
5. Missing heads replaces (stolen or otherwise).
6. Broken risers replaced.
7. Gate valves and control valves operation properly and not leaking.
8. Controller operating properly and programmed.
9. Any inconsistencies to the Specification will be noted by the Architects's

representative and a written copy of corrections will be given to the Irrigation Contractor. The City's representative will not accept. The system until the corrections from the final inspection have been made by the Irrigation Contractor.

33.08 MAINTENANCE

The maintenance of the irrigation system once installed needs to be provided including:

- A. A description of routine maintenance for (1) year must be developed. Spring start ups and winterization must be included as well as regular monthly check-ups throughout the season of operation.
- B. A schedule for (1) year of maintenance must be submitted for review by the City's representative, agreed upon and followed by the contractor.
- C. Maintenance responsibilities must be assigned to an appointed and qualified employee or outsourced to a private company which specializes in the maintenance and repair of irrigation systems.

33.09 OPERATION

The operation of the system is critical to delivering the correct amount of water required by the plant material.

- A. A watering schedule must be developed to assure plant material is receiving adequate water. The schedule should be developed in consultation with the City's Engineer, Landscape Architect or representative.
- B. The water schedule must be assigned to an appointed and qualified employee or outsourced to a private company.
- C. The watering schedule must be created around the anticipated water requirements of the plant material.

33.10 REPLACEMENTS AND GUARANTEE

The new irrigation system workmanship and materials shall be guaranteed for the period of one (1) year from the date of acceptance of work. The irrigation contractor shall be responsible for proper winterization of the irrigation system during the one (1) year guaranteed period. This shall include at least one winterization and one spring charge-up of the system.

Should any trouble develop within the time specified above due to faulty materials or material, the defect shall be corrected by the Irrigation Contractor without expense to the owner. The irrigation contractor is not responsible for repair of sprinkler system due to vandalism, fire, theft acts beyond the contractor's control.

33.11 QUALIFICATION FOR SUBMITTING BIDS

The installation of the irrigation system needs to be performed at a level which will insure the longevity of the system. It is recommended that the following requirements be established:

- A. The contractor performing the work must be a certified irrigation contractor and fully insured and licensed.
- B. The contractor performing the work must be able to demonstrate a minimum work experience record.
- C. The contractor performing the work must have successfully completed projects similar in scope and scale.

33.12 REQUIREMENTS FOR SUBMITTING BIDS

All bids submitted must include the following information on the **BID PROPOSAL**:

The item of Irrigation system shall be measured as a Lump Sum item, including, boring, materials, labor, and incidental operations as called for in these specifications, and shall be listed on the bid PROPOSAL. Materials as specified on the bid PROPOSAL which cannot be furnished, delivered and installed should be noted in writing as “not available” on the bid PROPOSAL form.

All bid prices shall be firm and shall include all necessary labor, materials and equipment required as specified within these specifications.

Bids submitted shall conform to the contract forms and the specific requirements of these specifications.

Payment for Irrigation System is on a Lump sum basis in accordance with the general conditions of the City of Lincoln Standards and specifications. The price shall be full compensations for furnishing and installation all materials, equipment and incidentals necessary to complete the work as specified here in.

If sidewalk, street or curb removal and replacement is required, it will be determined to be incidental to Irrigation System, and separate payment will not be made.

After award of contract: Prior to construction, submit manufacturer's product data on each type of irrigation product. Two copies of bound Product data shall be submitted with other Submittal required for the contract.

Submit manufacturer's product data and installation instructions for each of the system components.

Submit shop drawings for underground irrigation system, including plan layout and details illustrating location and type of heads, valves, piping circuits, controls and accessories. Submit technical data supporting layout design, including individual circuit (section) GPM and pressure loss calculations.